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December 13, 2001

**By Hand Delivery**

Magalie R. Salas, Esq.  
Secretary  
Federal Communications Commission  
445 12th Street, S.W.  
Washington, D.C. 20554

**RECEIVED**

DEC 13 2001

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

Re: CC Docket Nos. 00-218 & 00-251/  
In the Matter of Petition of AT&T Communications of Virginia, Inc., TCG Virginia, Inc., ACC National Telecom Corp., MediaOne of Virginia and MediaOne Telecommunications of Virginia, Inc. for Arbitration of an Interconnection Agreement With Verizon Virginia, Inc. Pursuant to Section 252(e)(5) of the Telecommunications Act of 1996

In the Matter of Petition of WorldCom, Inc. Pursuant to Section 252(e)(5) of the Communications Act for Expedited Preemption of the Jurisdiction of the CC Docket No. 00-218 Virginia State Corporation Commission Regarding Interconnection Disputes with Verizon Virginia Inc., and for Expedited Arbitration

Dear Ms. Salas:

Enclosed please find an original and three (3) copies of the responses of AT&T and WorldCom to the following record requests by Commission staff concerning the cost of capital estimates of AT&T/WorldCom witness John Hirshleifer. The requests are:

- (1) Please place into the record documentation explaining how BARRA estimates equity betas. Tr. 3676 (Oct. 24, 2001) (request no. 13).
- (2) Please place into the record, on a computer disk, the UNE cost-of-equity capital study that is reflected in AT&T/WorldCom's proposed UNE cost of capital for Verizon-VA. As part of this request, please include all models, formulas, equations, work papers, data, calculations, and a list of assumptions and a list of

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Magalie R. Salas, Esq.  
December 12, 2001  
Page 2

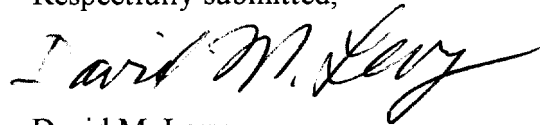
cites to sources of all data reflected in this study (the list of assumptions and the list of cites to the data sources may be provided on hard copy). Please submit this information in the software format used to develop the study. For example, submit this information in Excel if Excel was used to make calculations, not in PDF format. The software should retain any formulas rather than just values developed as part of that study. It should permit the staff to revise the study by editing the submitted study instead of replicating it entirely and then making changes to the replicated study. Tr. 3764 (Oct. 25, 2001) (request no. 2).

- (3) Please submit cites to any literature that compares the relative accuracy of one-stage versus multi-stage discounted cash flow models. Tr. 3766 (Oct. 25, 2001).

Copies of these documents were served upon the Commission Staff and the parties by e-mail yesterday evening.

Thank you for your consideration in this matter.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "David M. Levy". The signature is fluid and cursive, with a long, sweeping underline.

David M. Levy

cc: Dorothy Attwood  
Jeffrey Dygert  
Catherine Carpino  
Aaron Goldschmidt  
Katherine Farroba  
Counsel of Record  
Catherine Ronis

Enclosures

**Before the  
Federal Communications Commission  
Washington, D.C. 20554**

In the Matter of Petition of AT&T	)	
Communications of Virginia, Inc.,	)	
Pursuant to Section 252(e)(5) of the	)	
Communications Act, for Preemption of	)	
the Jurisdiction of the Virginia State	)	CC Docket No. 00-251
Corporation Commission Regarding	)	
Interconnection Disputes with Verizon-	)	
Virginia, Inc.	)	

In the Matter of Petition of WorldCom,	)	
Inc. Pursuant to Section 252(e)(5) of the	)	
Communications Act for Expedited	)	
Preemption of the Jurisdiction of the	)	
Virginia State Corporation Commission	)	CC Docket No. 00-218
Regarding Interconnection Disputes	)	
with Verizon Virginia Inc., and for	)	
Expedited Arbitration	)	

**CERTIFICATE OF SERVICE**

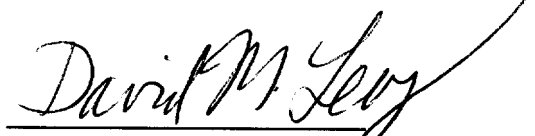
I hereby certify that on this 12th day of December, 2001, copies of the three attached responses to Staff record requests were sent via hand delivery, and/or electronic mail to:

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\_\_\_\_\_  
David M. Levy

**Response of AT&T and WorldCom to Staff Record Request  
for documentation of how BARRA estimates equity betas**

**REQUEST:** Please place into the record documentation explaining how BARRA estimates equity betas. *See* Tr. 3676 (Oct. 24, 2001) (request no. 13).

**RESPONSE:** Please see BARRA, *United States Equity Model Handbook*, pp. 19-23 and 48-60 (attached).



01-12-12 AT&T-WCOM  
response to...



# *United States Equity Model*

HANDBOOK

## IV. The United States Equity Model

The United States Equity Model adapts the principles of BARRA's E2 Equity Model to the United States. The primary functions of the U.S. Model are (1) to predict risk and (2) to explain return. The model, like other MFM's, analyzes risk exposures based on factors identified by BARRA. In addition to industry classification, these common factors categorize a portfolio's exposures across industry boundaries, such as growth and financial leverage, providing useful information for portfolio construction.

### Model Development

Model development is both an art and a science. The art is the selection of common factors and industries that will sufficiently capture the risk exposures of a portfolio. This largely qualitative process combines experience and judgment with quantitative testing.

The science of model development is the process of assigning weights to these explanatory variables and calculating comparative values that are meaningful to investors. Through cross-sectional regressions, common factor returns are calculated. The covariances of these returns are the building blocks of the covariance matrix used in risk analysis. This procedure is explained further in *Chapter V. Model Estimation*.

The equation for the U.S. Equity Model is derived from the basic MFM equation and adapted to include 68 factors (13 risk indices and 55 industries) and their exposures (weights). The model equation is:

$$\tilde{r}_j = b_{j1} \tilde{r}_1 + \dots + b_{j68} \tilde{r}_{68} + \tilde{u}_j \quad \text{Equation IV-1}$$

where  $\tilde{r}_j$  = excess return on security  $j$ ,

$b_{jk}$  = exposure of security  $j$  to factor  $k$ ,

$\tilde{r}_k$  = return on factor  $k$ , and

$\tilde{u}_j$  = specific return on security  $j$ .

### Risk Indices

The U.S. Model contains 13 risk indices, reflecting common characteristics among companies. Risk indices quantify common factor influences for portfolio analysis. They provide easily interpreted comparative information about sources of risk. The higher the absolute value of the risk index value, the greater the factor's influence on total portfolio risk.

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Descriptors, the building blocks of risk indices, are descriptive variables designed to measure attributes of a company. The 70 descriptors in the U.S. Model are standardized with respect to the estimation universe, BARRA's HICAP, using the capitalization-weighted mean and the equally-weighted standard deviation. Related descriptors are then organized into risk indices for easy analysis. This process also tends to eliminate noise in individual descriptors.

The risk indices are listed below with their related descriptors. Positive and negative influences are indicated by plus (+) and minus (-) signs respectively.

**1. Variability in Markets (VIM)**

This risk index is a predictor of the volatility of a stock based on its behavior and the behavior of its options in the capital markets. Unlike beta, which measures only the response of a stock to the market, Variability in Markets measures a stock's *overall* volatility, *including* its response to the market. A high beta stock will necessarily have a high Variability in Markets exposure. However, a high exposure will not necessarily imply a high beta; the stock may be responding to factors other than changes in the market.

This index uses measures such as the cumulative trading range and daily stock price standard deviation to identify stocks with highly variable prices. BARRA uses different formulas for three categories of stocks.

- a. **Optioned stocks**—all stocks having listed options.
- b. **Listed stocks**—all stocks in the HICAP universe that are listed on an exchange but do not have listed options.
- c. **Thin stocks**—all stocks that are traded over the counter or are outside the HICAP universe, except those with listed options.

Optioned stocks are distinct for several reasons. First, the option price provides an implicit forecast of the total standard deviation of the stock itself. Second, optioned stocks tend to be those with greatest investor interest and with the most effective trading volume. Stock trading volume descriptors understate the effective volume because they omit option volume.

Thin stocks, about ten percent of the basic sample, are broken out because they tend to trade differently from other stocks. Over-the-counter stocks and other thinly traded securities show price behavior inconsistent with efficient and timely prices. Thin stocks are less synchronized with market movements, and exhibit frequent periods in which no meaningful price changes occur as well as occasional outlying price changes that are promptly reversed. These influences cause some indicators of stock price variability to be biased.

In calculating this index, BARRA standardizes the formulas for the three stock categories relative to one another to provide one index for the total population.

**A. Optioned Stock Descriptors**

- + Cumulative Range, 12 months
- + Beta \* Sigma
- + Option Standard Deviation
- + Daily Standard Deviation

**B. Listed Stock Descriptors**

- + Beta \* Sigma
- + Cumulative Range, 12 months
- + Daily Standard Deviation
- + Trading Volume to Variance
- Log of Common Stock Price
- + Serial Dependence
- Annual Share Turnover

**C. Thin Stock Descriptors**

- + Beta \* Sigma
- + Cumulative Range, 12 months
- + Annual Share Turnover
- Log of Common Stock Price
- Serial Dependence

**2. Success (SCS)**

The Success index identifies recently successful stocks using price behavior in the market (measured by historical alpha and relative strength) and, to a lesser degree, earnings growth information. The relative strength of a stock is significant in explaining its volatility.

- + Relative Strength
- + Historical Alpha
- + Recent Earnings Change
- + IBES Earnings Growth
- Dividend Cuts, 5 years
- + Growth in Earnings per Share

**3. Size (SIZ)**

The Size Index values total assets and market capitalization to differentiate large stocks from small stocks. This index has been a major determinant of performance over the years as well as an important source of risk.

- + Log of Capitalization
- + Log of Total Assets
- + Indicator of Earnings History

**4. Trading Activity (TRA)**

Trading activity measures the relative activity of a firm's shares in the market, or the "institutional popularity" of a company. The most important descriptors are the share turnover variables. In addition, this index includes the ratio of trading volume to price



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variability, the logarithm of price, and the number of analysts following the stock, as reported in the IBES database. The stocks with more rapid share turnover, lower price, and signs of greater trading activity are generally the higher risk stocks.

- + Annual Share Turnover
- + Quarterly Share Turnover
- + Share Turnover, 5 years
- + Log of Common Stock Price
- + IBES Number of Analysts
- + Trading Volume to Variance

**5. Growth (GRO)**

The Growth Index is primarily a predictor of a company's future growth but also reflects its historical growth. BARRA estimates earnings growth for the next five years using regression techniques on a comprehensive collection of descriptors, all of which are distinct elements of the growth concept. The Growth Index includes descriptors of payout, asset growth and historical growth in earnings, the level of earnings to price, and variability in capital structure.

- Payout, 5 years
- Earnings to Price Ratio, 5 years
- + Earnings Growth
- + Capital Structure Change
- Normalized Earnings to Price Ratio
- + Recent Earnings Change
- Dividend Yield, 5 years
- + IBES Earnings Change
- Yield Forecast
- + Indicator of Zero Yield
- Earnings to Price Ratio
- IBES Earnings to Price Ratio
- + Growth in Total Assets

**6. Earnings to Price Ratio (EPR)**

The Earnings to Price Ratio measures the relationship between company earnings and market valuation. To compute the Earnings to Price Ratio, BARRA combines measures of past, current, and estimated future earnings.

- + Current Earnings to Price Ratio
- + Earnings to Price Ratio, 5 years
- + IBES Earnings to Price Ratio Projection

**7. Book to Price Ratio (BPR)**

This index is simply the book value of common equity divided by the market capitalization of a firm.

**8. Earnings Variability (EVR)**

The Earnings Variability index measures a company's historical earnings variability and cash flow fluctuations. In addition to variance in earnings over five years, it includes the relative variability of earnings forecasts taken from the IBES database, and the industry concentration of a firm's activities.

- + Variance in Earnings
- + IBES Standard Deviation to Price Ratio
- + Earnings Covariability
- + Concentration
- + Variance of Cash Flow
- + Extraordinary Items

**9. Financial Leverage (FLV)**

The Financial Leverage index captures the financial structure of a firm as well as its sensitivity to interest rates using the debt to assets ratio, the leverage at book value, and the probability of fixed charges not being covered. Bond market sensitivity is included only for financial companies.

- Bond Market Sensitivity
- + Debt to Assets Ratio
- + Leverage at Book (Debt to Equity)
- + Uncovered Fixed Charges

**10. Foreign Income (FOR)**

This index reflects the fraction of operating income earned outside the United States. It is a measure of sensitivity to currency exchange rate changes.

**11. Labor Intensity (LBI)**

This index estimates the importance of labor, relative to capital, in the operations of a firm. It is based on ratios of labor expense to assets, fixed plant and equipment to equity, and depreciated plant value to total plant cost. A higher exposure to Labor Intensity indicates a larger ratio of labor expense to capital costs and can be a gauge of sensitivity to cost-push inflation.

- + Labor Share
- Inflation-adjusted Plant to Equity Ratio
- Net Plant to Gross Plant

**12. Yield (YLD)**

The Yield index is simply a relative measure of the company's annual dividend yield.

**13. LOCAP**

The LOCAP characteristic indicates those companies that are not in the HICAP universe. It permits the factors in the model to be applied across a broader universe of assets than that used to estimate the model. The LOCAP factor is, in part, an extension of the Size index, allowing the returns of approximately 4500 smaller companies to deviate from an exact linear relationship with the Size index.

## Appendix A: Descriptors

### ABET

Accounting beta.

$$ABET = \hat{\beta} \cdot \frac{\sum_{t=1}^T AEPS_t}{\sum_{t=1}^T |EPS_t|}$$

where  $\hat{\beta}$  is from regression:

$$EPS_t - EPS_{t-1} = \hat{\alpha} + \hat{\beta} \cdot (AEPS_t - AEPS_{t-1})$$

$EPS_t$  = time series of net earnings per share,

$AEPS_t$  = time series of matched aggregate EPS, and

$T$  = number of period (all history in available data).

### ADVI

Advertising intensity (annual).

$$ADVI = \frac{\text{amount of money on advertisement}}{\text{sales (net)}}$$

### AGRO

Asset growth rate, equal to the annual trend in total assets divided by average value, last five years.

$$AGRO = \frac{\text{regression coefficient of } x \text{ on } t}{|\bar{x}|}$$

where  $x$  = total assets,

$t$  = yearly index;  $t = 1, 2, 3, 4, 5$ , and

the sums are over the last five years, or over years for which all data exist.

### ASSI

Logarithm of total assets.

ASSI = the natural log of total assets.

**ATAX**

Tax to earnings.

$$ATAX = \frac{5 \text{ years of total income tax}}{5 \text{ year sum of PREIN}}$$

where PREIN = total income tax + income (net)  
+ minority interest,

$$ATAX = 0.55, \text{ if } ATAX > 0.55, \text{ and}$$

$$ATAX = 0.1375, \text{ if } ATAX < 0.1375.$$

**BBET**

Beaver beta.

$$BBET = \hat{\beta} \cdot \frac{\sum_{t=1}^T AETP_t}{\sum_{t=1}^T \left[ \frac{EARN_t}{MKTVALUE_t} \cdot 1000 \right]}$$

where  $\hat{\beta}$  is from regression:

$$\frac{EARN_t}{MKTVALUE_t} \cdot 1000 = \hat{\alpha} + \hat{\beta} \cdot AETP_t,$$

$EARN_t$  = time series of net earnings,

$MKTVALUE_t$  = historical market value, arranged by  
fiscal dates,

$AETP_t$  = time series of matched aggregate earning  
to price, and

$T$  = number of period (all history in available data).

**BLEV**

Book leverage.

$$BLEV = \frac{[(\text{preferred stock}) + (\text{common equity}) + (\text{long term debt})]}{[\text{common equity} + \text{intangibles}]}$$

**BTOP**

Book value to price.

$$BTOP = \frac{\text{common equity} + \text{intangibles}}{\text{market capitalization}}$$

where

market capitalization = (shares outstanding) \* (price per share),

and price is the latest monthly closing price.

**BTSQ** Square root of the product of beta and sigma.

$$\text{BTSQ} = \sqrt{(\text{historical beta}) \cdot (\text{historical sigma})}.$$

**BTSQ** Historical beta squared.

$$\text{BTSQ} = (\text{HBETA})^2.$$

**CAPT** Market capitalization.

$$\text{CAPT} = (\text{price}) \cdot (\text{shares}).$$

**CMRA** Cumulative range, last 12 months, in logarithms.

$$\text{CMRA} = \ln \left( \frac{\text{max price}}{\text{min price}} \right).$$

where max price = the maximum price over the last 12 months,

min price = the minimum price over the last 12 months, and

prices are adjusted for capital transactions and dividends.

**CONC** A measure of the absence of diversification across industries.

$$\text{CONC} = \frac{\sum_i \{\text{average } i\}^2}{\{\text{average } [\text{total operating earnings}]\}^2}.$$

where  $i$  = operating earnings from industry group,

the sum is taken for industry groups for which earnings are reported for firm, and

each average is taken of last three years.

**CUTD** Average proportional cut in dividends, last five fiscal years.

CUTD = average over the last four years of DIF,

$$\text{where DIF} = 2 \left( \frac{\text{annual common div}(t-1) - \text{annual common div}(t)}{[\text{common div}(t-1)] + [\text{common div}(t)]} \right),$$

when  $\text{common div}(t) < \text{common div}(t-1)$ , or

= 0, when otherwise.

**DASTD**

Inflation-adjusted PTEQ, plant to book.

$$\text{DASTD} = \frac{\text{plant value}}{\text{common equity} + \text{intangibles}}$$

**DELE**

Delta earnings; a measure of proportional changes in adjusted earnings per share in the last two fiscal years.

$$\text{DELE} = \frac{2[(\text{earnings} / \text{share year } T) - (\text{earnings} / \text{share year } T - 1)]}{|\text{earnings} / \text{share year } T| + |\text{earnings} / \text{share year } T - 1|} \text{ or}$$

$$= 0 \text{ when earnings are zero in both years,}$$

where earnings/share are adjusted for capital transactions.

**DILU**

Potential dilution, excluding extraordinary items.

$$\text{DILU} = \left| \frac{\text{fully diluted earnings per share}}{\text{earnings per share}} \right|$$

where  $\text{DILU} = 1.2$ , if  $\text{DILU} > 1.2$ .**DMNE**

Indicator of small earnings to price.

 $\text{DMNE} = 1$ , if earnings to price is  $\leq 0.005$ , or $= 0$ , if otherwise.**DMS5**

Indicator of availability of a five-year history of earnings information.

 $\text{DMS5} = 1$ , if there are at least four data points available for the calculation of EGRO (see below), or $= 0$ , in all other cases.**DMYL**

Indicator of extremely low yield.

 $\text{DMYL} = 0$ , if yield  $> .005$ , or $= 1$ , if yield  $\leq .005$ .**DTOA**

Total debt to assets.

$$\text{DTOA} = \frac{\text{total debt}}{\text{total assets}}$$

**DTXO**

Tax liability adjusted for monetary debt.

$$DTXO = \frac{ATAX * (DETAX - PFDLQ - NPPE)}{\text{market capitalization}}$$

where ATAX = tax to earnings (5 years),  
 DETAX = deferred taxes and investment tax credit (balance sheet),  
 PFDLQ = preferred stock liquidation value, and  
 NPPE = net property, plant, and equipment.

**EGIBS**

IBES earnings growth.

$$EGIBS = \frac{\text{projected earnings} - \text{realized earnings}}{\text{average projected earnings} + \text{average realized earnings}}$$

**EGRO**

Earnings growth rate equal to annual trend rate in earnings divided by average earnings, for last five years.

$$EGRO = \frac{\text{regression coefficient of } x \text{ on } t}{|\bar{x}|}$$

where  $x$  = earnings per share, adjusted for capital transactions,  
 $t$  = yearly index;  $t = 1, 2, 3, 4, 5$ , and  
 the sums are over the last five years, or over years for which all data exist.

**ENTP**

Normalized earnings/price ratio.

$$ENTP = \frac{\bar{x} + 2(\text{regression coefficient of } x \text{ on } t)}{\text{price}}$$

where  $x$  = earnings per share, adjusted for capital transactions,  
 $t$  = yearly index;  $t = 1, 2, 3, 4, 5$ , and  
 the sums are over the last five years, or over years for which all data exist.

**EPIBS**

IBES earnings to price projection.

$$EPIBS = \frac{w_1 \text{Eam}_1 + w_2 \text{Eam}_2}{\text{price}}$$

where  $\text{Eam}_1$  = earnings at  $t_1$ , $\text{Eam}_2$  = earnings at  $t_2$ , and $w_1 + w_2 = 1$ ,where  $w_1$  = weight at time period 1, and $w_2$  = weight at time period 2.**ETOP**

Earnings to price.

$$ETOP = \frac{\text{income before extraordinary items}}{\text{market capitalization}}$$

**ETP5**

Typical earnings price ratio for the last five years.

$$ETP5 = \frac{\left[ \text{average over last 5 yrs of } \left( \frac{\text{adjusted available for common}}{\text{adjusted shares outstanding}} \right) \right]}{\left[ \text{average over last 5 yrs of (adjusted closing stock price)} \right]}$$

**EXTE**

Typical proportion of earnings that are extraordinary items.

$$EXTE = \frac{\sum_{i=1}^5 [\text{extraordinary items} + \text{nonrecurring income / expense}]}{\sum_{i=1}^5 [\text{earnings}]}$$

where earnings = earnings available for common less preferred dividends, and the averages are over the last five years.

**FLOW**

Cash flow to current liability.

$$FLOW = \frac{\text{5 years average of CASHFLO}}{\text{current liability}}$$

where CASHFLO = income before extraordinary items  
(adjusted for common stock equity)  
+ depreciation and amortization  
+ deferred taxes (income account),

FLOW = 5, if FLOW &gt; 5, and

FLOW = -5, if FLOW &lt; -5.



**FRGN**

Foreign operating income as a percent of total operating income.

$$\text{FRGN} = \frac{\text{foreign operating income}}{\text{total operating income}}$$

**HALPHA**

Historical alpha; the intercept term in a regression of monthly stock returns on monthly returns for the market.

$$r_t = \hat{\alpha} + \hat{\beta} r_{M_t}$$

where  $r_t$  = excess return in time  $t$ ,

$r_{M_t}$  = excess market return in time  $t$ , and

$\hat{\alpha}$  = intercept of regression.

**HBETA**

Historical beta; the regression coefficient in a regression of monthly stock returns on monthly returns for the market.

$$r_t = \hat{\alpha} + \hat{\beta} r_{M_t}$$

where  $r_t$  = excess return in time  $t$ ,

$r_{M_t}$  = excess market return in time  $t$ , and

$\hat{\beta}$  = regression coefficient

**HSIG**

Historical sigma; standard deviation of residual risk equal to square root of residual mean square in beta regression.

$$\text{HSIG} = \left\{ \frac{1}{T-2} \sum_{t=1}^T \hat{e}_t^2 \right\}^{1/2}$$

where  $\hat{e}_t$  = the residual in the regression for historical beta in month  $t$

=  $r_t - \hat{r}_t$ , and

$T$  = the number of data points available.

**IRSN**

Bond market sensitivity; measures an asset's historical response to interest rate changes by regressing excess stock returns on Shearson Lehman Government Corporate Index bond returns and S&P500 returns.

$$r_t = \alpha + \beta_D [r_{D_t}] + \beta_S [r_{M_t}]$$

where  $r_{D_t}$  = excess bond market return,

$r_{M_t}$  = excess stock market return, and

$\beta_S$  = bond market sensitivity of asset.

**LBRS**

Labor share.

$$LBRS = \frac{\text{wages}}{\text{total assets}}$$

**LIQU**

Liquid assets to current liability.

$$LIQU = \frac{(\text{cash \& short investment}) + (\text{account receivables}) - (\text{current liability})}{\text{market capitalization}}$$

where market capitalization = (price) \* (shares).

**LNCAP**

An indicator of capitalization, equal to the natural logarithm of the market value of common equity.

$$LNCAP = \ln [(\text{number of shares outstanding}) * (\text{price per share})]$$

where price is the latest monthly closing price.

**LPRI**

Natural logarithm of unadjusted stock price.

$$LPRI = \ln (\text{unadjusted price}),$$

where price = price for most recent month, if available,

or, if unavailable,

= price at end of previous calendar year.

**MLEV**

Leverage at market.

$$MLEV = \frac{(\text{preferred stock}) + (\text{market capitalization}) + (\text{long-term debt})}{\text{market capitalization}}$$

**NPGP** Net plant to gross plant.

$$\text{NPGP} = \frac{\text{net property, plant, and equipment}}{\text{gross property, plant, and equipment}}$$

**NUMA** IBES number of analysts making earnings forecasts for a company.

**OPSTD** Option implied standard deviation calculated using the Black-Scholes formula.

$$P_o = P_s N(d_1) - E e^{-rt} N(d_2)$$

$$\text{where } d_1 = \frac{\ln(P_s/E) + (r + \sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

$P_o$  = current option value,

$P_s$  = current stock price,

$E$  = exercise price of option,

$e$  = 2.71828,

$T$  = time to maturity of option in years,

$r$  = risk-free interest rate,

$\sigma$  = OPSTD, and

$N(d)$  = probability that a deviation less than  $d$  will occur in a standard normal distribution.

**PAYO** A measure of normal payout in the last five years.

$\text{PAYO} = \frac{\text{the sum over the last five years of common dividends}}{\text{the sum over the last five years of earnings available for common}}$

$$= \frac{\sum_{t=4}^6 \text{div}_t}{\sum_{t=4}^6 \text{Ecom}_t}$$

where both pieces of data must be available before any one year is included.

**PLTAS** Ratio of plant to common shareholders' equity.

$$\text{PLTAS} = \frac{\text{gross plant, property, and equipment}}{\text{book value of common equity}}$$

**PNCV**

Estimated probability of non-coverage of fixed charges, using a trended value for current operating income.

$$PNCV = z \left[ \frac{(\text{fixed charges}) - (\text{forecasted operating income})}{\sigma} \right],$$

where  $z[x] = \text{PROB}[N(0,1) < x]$  is the cumulative standard normal distribution,

$\sigma$  = the standard error of operating income over the last five years:

$$\sigma = \sqrt{\frac{\sum (x_t - \bar{x})^2}{N-1}}$$

"forecasted operating income" = (average operating income over the last five years) + 2(TREND), and

$$\text{TREND} = \frac{\sum tx - \frac{1}{N}(\sum t)(\sum x)}{\sum t^2 - \frac{1}{N}(\sum t)^2}$$

where  $x$  = operating income,

$t$  = yearly index;  $t = 1, 2, 3, 4, 5$ ,

the sums are over the last five years, or over those years when data were available, and

$N$  is the number of years for which data exist.

**PRDE**

Price deflated earnings adjustment.

$$\text{PRDE} = \frac{\text{OI} - \text{FX} - \text{IT} + \text{CA} + \text{RE} - \text{LI} + \text{LD} + \text{DT} + \text{LQ} + \text{DP} - \text{adjusted price}}{\text{market capitalization}}$$

where OI = operating income before depreciation,  
 FX = interest expense,  
 IT = income tax (total),  
 CA = cash and short investment,  
 RE = receivables (total),  
 LI = current liabilities,  
 LD = long-term debt,  
 DT = deferred taxes,  
 LQ = preferred stock liquidation, and  
 DP = depreciation and amortization.

**ROEQ**

Return on equity over the past 5 years.

$$\text{ROEQ} = \frac{\sum_{t=-4}^0 [\text{adjusted available for common}(t)]}{\sum_{t=-4}^0 [\text{book value of common equity}(t)]}$$

**RPTE**

Real (inflation-adjusted) plant to equity.

$$\text{RPTE} = \frac{\text{estimated current market value of plant adjusted for inflation}}{\text{book value of equity}}$$

**RSTR**

Logarithmic rate of return over last year (relative strength).

$$\text{RSTR} = \sum_{t=-11}^0 \ln(1 + r_t)$$

where  $r_t$  = excess asset return over month  $t$ .Note: Normalization converts this to a *relative* strength measure.**SEHBET**

Standard deviation of HBETA.

**SEHSIG**

Standard deviation of HSIG.

**SERDP**Serial dependence from  $\beta$  regression; the first order correlation of residuals from historic  $\beta$  regression.

$$\text{SERDP} = \frac{\sum_{t=-57}^0 (R_t + R_{t-1} + R_{t-2})^2}{\sum_{t=-57}^0 (R_t^2 + R_{t-1}^2 + R_{t-2}^2)}$$

where  $R_t$  = residual at time  $t$ **SGSQ**

Historical sigma squared.

$$\text{SGSQ} = (\text{HSIG})^2$$

**STDP**

IBES standard deviation to price.

$$\text{STDP} = \text{STD} \frac{\text{earnings forecast}}{\text{capitalization}}$$

**STOA / STOQ / STOS**

Annual, quarterly, and 60-month calculations of share turnover.

$$\text{Share Turnover} = \frac{\text{Annualized percentage of market capitalization traded}}{\text{market capitalization}}$$

**TREC**

Trading recency.

$$\text{TREC} = \frac{12}{\text{number of months the stock is traded}}$$

where TREC = 0, if number of months traded &gt; 100, and

TREC = 1, if number of months traded &lt; 12.

**VCAP**

Variation in capital structure.

$$\text{VCAP} = \frac{\sum_{t=1}^5 \left\{ \begin{array}{l} | \text{common shares } (t-1) - \text{shares } (t) + \text{price } (t-1) | \\ + | \text{long-term debt } (t-1) - \text{long-term debt } (t) | \\ + | \text{preferred equity } (t) - \text{preferred equity } (t-1) | \end{array} \right\}}{4 \left[ | \text{common equity} | + | \text{long-term debt} | + | \text{preferred stock} | \right]}$$

**VERN**

Variability (coefficient of variation) of annual earnings in last five years.

$$\text{VERN} = \frac{\sqrt{\frac{\sum_{t=0}^4 (\text{EPS} - \text{average earnings})^2}{T-1}}}{| \text{average earnings} |}$$

where EPS = earnings per share

$$= \frac{\text{standard deviation of EPS}}{| \text{average earnings} |}$$

average earnings include earnings over the preceding five years,

T is the number of years that data exist, and

if VERN &gt; 5, VERN is set to 5.

**VFLO**

Variability (coefficient of variation) of cashflow.

$$VFLO = \frac{\sqrt{\frac{\sum_{t=1}^T (\text{cash flow} - \text{average cash flow})^2}{T-1}}}{|\text{average cash flow}|}$$

where cashflow = (available for common)  
+ (depreciation) + (deferred taxes).

**VLVR**

Logarithm of trading volume to variation of price in the previous year.

$$VLVR = \ln [(\text{shares traded in previous year})(\text{price})] - ABRA$$

where price = price at end of previous calendar year,  
if available, or, if unavailable,  
= monthly closing price in latest month, and  
ABRA is the absolute monthly range.

**YIELD**

$$\text{Current dividend yield} = \frac{\text{latest dividend}}{\text{most recent price}}$$

**YLD5**

Yield, normal value for last five years.

$$YLD5 = \frac{\sum_{t=1}^5 \text{yield}(t)}{5}$$

**Response of AT&T and WorldCom to Staff Record Request  
for documentation of AT&T/WorldCom study  
of Verizon-VA equity cost of capital**

**REQUEST:** Please place into the record, on a computer disk, the UNE cost-of-equity capital study that is reflected in AT&T/WorldCom's proposed UNE cost of capital for Verizon-VA. As part of this request, please include all models, formulas, equations, work papers, data, calculations, and a list of assumptions and a list of cites to sources of all data reflected in this study (the list of assumptions and the list of cites to the data sources may be provided on hard copy). Please submit this information in the software format used to develop the study. For example, submit this information in Excel if Excel was used to make calculations, not in PDF format. The software should retain any formulas rather than just values developed as part of that study. It should permit the staff to revise the study by editing the submitted study instead of replicating it entirely and then making changes to the replicated study. *See* Tr. 3764 (Oct. 25, 2001) (request no. 2).

**RESPONSE:** The attached Excel file contains the requested information:





### 3-stage DCF Model

Stock Price	42.6250
Expected Dividend	0.80
I/B/E/S 5-Year Growth Rate	11.07%
Long-Term Growth Rate	6.285%
Cost of Equity	9.13%

Period	Growth Rate	Dividend Amount	PV of Dividend
<b>42.62</b>			
0			
1		0.80	0.73
2	11.07%	0.89	0.75
3	11.07%	0.99	0.76
4	11.07%	1.10	0.77
5	11.07%	1.22	0.79
6	10.75%	1.35	0.80
7	10.43%	1.49	0.81
8	10.11%	1.64	0.81
9	9.79%	1.80	0.82
10	9.48%	1.97	0.82
11	9.16%	2.15	0.82
12	8.84%	2.34	0.82
13	8.52%	2.54	0.82
14	8.20%	2.75	0.81
15	7.88%	2.97	0.80
16	7.56%	3.19	0.79
17	7.24%	3.42	0.77
18	6.92%	3.66	0.76
19	6.60%	3.90	0.74
20	6.29%	4.14	0.72
Terminal	6.29%	154.60	26.92

### 3-stage DCF Model - Verizon

Stock Price	55.00
Last Dividend Declared	1.54
I/B/E/S 5-Year Growth Rate	11.65%
Long-Term Growth Rate	6.285%
Cost of Equity	11.07%

Period	Growth Rate	Dividend Amount	PV of Dividend
			<b>55.00</b>
0		1.54	
1	11.65%	1.72	1.55
2	11.65%	1.92	1.56
3	11.65%	2.14	1.56
4	11.65%	2.39	1.57
5	11.65%	2.67	1.58
6	11.29%	2.97	1.58
7	10.93%	3.30	1.58
8	10.58%	3.65	1.58
9	10.22%	4.02	1.56
10	9.86%	4.42	1.55
11	9.50%	4.84	1.52
12	9.15%	5.28	1.50
13	8.79%	5.74	1.47
14	8.43%	6.23	1.43
15	8.07%	6.73	1.39
16	7.72%	7.25	1.35
17	7.36%	7.78	1.31
18	7.00%	8.33	1.26
19	6.64%	8.88	1.21
20	6.28%	9.44	1.16
Terminal	6.29%	209.85	25.72

Model Estimates of Cost of Capital

Company	S&P Stock Guide	(07/07/00 Value Line)	Forward-looking Dividend Yield	Jun-00 IBES 5-yr growth	WEFA 6/00, Ibbotson COCQ 6/00 Long-Term Economy Growth Rate	S&P Stock Guide C/S Outst (millions)	Market Value Equity	Market Weight	S&P Bond Guide (as of 6/30/00) COST OF DEBT	DCF		(as of 6-00) BARRA Beta	Debt/Equity	Unlevered Beta	Re-levered Beta	CA 1-month Treasury Bills
	Price as of 6/30/00	2001 Dividend per Value Line								Co's	1/4-3/4 Weighted					
Verizon (7/3/00)	\$55.000	\$1.54	3.13%	11.65%	6.285%	2,760.000	\$151,800	37.70%	7.86%	11.07%	10.24%	0.682	0.351	0.56	0.77	10.71%
BellSouth	\$42.625	\$0.80	1.88%	11.07%	6.285%	1,881.533	\$80,200	19.92%	7.69%	9.13%	10.30%	0.645	0.212	0.57	0.71	10.26%
SBC Communications	\$43.250	\$1.02	2.36%	12.87%	6.285%	3,401.720	\$147,124	36.54%		10.34%	10.39%	0.825	0.175	0.74	0.70	10.18%
ALLTEL	\$61.938	\$1.34	2.16%	14.41%	6.285%	315.280	\$19,528	4.85%		10.49%	10.40%	0.742	0.231	0.65	0.72	10.33%
CenturyTel	\$28.750	\$0.22	0.77%	14.79%	6.285%	140.235	\$4,032	1.00%	8.54%	7.86%		0.841	0.503	0.64	0.83	11.16%

2.53% 12.15% \$402,684 100.00% 4.58% 10.38% 10.33% 0.73 0.63 0.73 = 4.93% + beta \* 0.075

DEBT EQUITY  
AVG BOOK 49.0% 51.0%  
AVG MARKET 20.0% 80.0%

Ibbotson	4.10%	long-term inflation
	3.50%	real GDP for 1929-1999
	7.60%	
WEFA	4.97%	long-term nominal GNP growth rate (2000-2025)
AVERAGE	6.285%	

TAX RATE: 37.5%

4.93%

M Cost of Equity			COST OF EQUITY (AVERAGE of DCF and CAPM Average)	BOOK		MARKET		WEIGHTED AVERAGE COST OF CAPITAL			2000 2Q 10-Q (\$million)			
Company	20-yr Treasury Bonds	Average		DEBT	EQUITY	DEBT	EQUITY	MIN	MIDPOINT	MAX	Short-Term Debt	Long-Term Debt	Book Debt	Book Equity
Verizon (7/3/00)	10.50%	10.60%	10.42%	49%	51%	26%	74%	9.17%	9.54%	9.91%	20,060	33,286	53,346	56,215
BellSouth	10.17%	10.21%	10.26%	51%	49%	17%	83%	9.00%	9.37%	9.75%	6,108	10,869	16,977	16,502
SBC Communications	10.11%	10.15%	10.27%	48%	52%	15%	85%				9,812	15,927	25,739	28,375
ALLTEL	10.22%	10.28%	10.34%	46%	54%	19%	81%				64	4,441	4,505	5,255
CenturyTel	10.83%	10.99%	10.99%	51%	49%	33%	67%	9.79%	10.14%	10.50%	75	1,954	2,029	1,948
	=6.26%+beta*0.055 6.26%	10.34%	10.34%	49.0%	51.0%	20.0%	80.0%				\$36,119	\$66,477	\$102,596	\$108,295

AVG BOOK  
AVG MARKET

Debt Implied: 34.5%  
Equity Implied: 65.5%

**Response of AT&T and WorldCom to Staff Record Request  
for citations to literature comparing the relative accuracy of  
one-stage versus multi-stage discounted cash flow models**

**REQUEST:** Please submit cites to any literature that compares the relative accuracy of one-stage versus multi-stage discounted cash flow models. See Tr. 3766 (Oct. 25, 2001).

**RESPONSE:** On pages 12-15 of his direct testimony (AT&T/WCOM Exh. 5), AT&T/WorldCom witness John Hirshleifer discusses the economic literature supporting the propositions that (1) short term earnings growth rates in excess of the long run growth rate of the economy are unsustainable into perpetuity, and (2) the simple constant growth model therefore cannot be applied unless one modifies the growth rate or adopts some mitigating assumption. The writings discussed in that portion of Mr. Hirshleifer's testimony are:

1. Stewart C. Myers and Lynda S. Borucki, "Discounted Cash Flow Estimates of the Cost of Equity Capital—A Case Study," *Financial Markets, Institutions & Instruments*, vol. 3, no. 3, New York University Salomon Center, 1994.
2. *Stock, Bonds, Bills and Inflation, 1998 Yearbook*, Ibbotson Associates, Chicago, pp. 161-162; *id.*, 2001 Yearbook, pp. )
3. Sharpe, William F., Gordon J. Alexander and Jeffrey V. Bailey, *Investments*, Prentice Hall, Englewood Cliffs, New Jersey, (5<sup>th</sup> ed., 1995), pp. 590-591.
4. Damodaran, Aswath, *Damodaran on Valuation: Security Analysis for Investment and Corporate Finance*, John Wiley & Sons, New York, 1994, pp. 99-101.
5. Copeland, Tom, Tim Koller, and Jack Murrin, *Valuation: Measuring and Managing the Value of Companies*, John Wiley & Sons, New York, 1994, pg. 295.

Additional books and articles supporting the same propositions, but not cited in Mr. Hirshleifer's testimony, include:

6. *Stock, Bonds, Bills and Inflation, 2001 Yearbook*, Ibbotson Associates, Chicago, pp. 49-50.
7. Shannon P. Pratt, *Cost of Capital: Estimation and Applications*, John Wiley & Sons, New York, 1998, pp.116-117.
8. Bradford Cornell, "Alternate Approaches Available for DCF Method," *Natural Gas*, November 1994, pp. 13-17.